



Red meat consumption and cardiovascular disease

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Article History

Received: 21 July 2017

Accepted: 07 September 2017

Published: 1 October 2017

Citation

Neil K Agarwal, Shashi K Agarwal. Red meat consumption and cardiovascular disease. *Discovery*, 2017, 53(262), 519-525

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General Note



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ABSTRACT

Several epidemiological and meta-analytical studies have concluded that consumption of red meat and processed meat leads to an increase in several chronic diseases. These include type II diabetes, colorectal cancer, and cardiovascular diseases. This dietary habit also leads to an increase in cardiovascular mortality and all-cause mortality. The detrimental association is seen in both men and women. These adverse effects are not seen with consumption of white meat. This review looks at the evidence based data behind

this association, the possible mechanisms involved and the emerging recommendations regarding red meat and processed meat intake.

Key Words: red meat, processed meat, plant based diet, cardiovascular diseases, cardiovascular mortality

1. INTRODUCTION

Several published epidemiological and prospective cohort studies have indicated that red meat intake is associated with a higher incidence of cardiovascular disease, especially ischemic heart disease, and cardiovascular mortality (Phillips et al, 1978; Snowdon et al, 1984). Most of the early reported work came from a strict lifestyle group called the Seventh-day Adventists – a religious group in California that is mainly vegetarian. It was suggested that besides mainly plant based diet, other factors like nonsmoking, exercise habits, and greater social support, were also responsible for their lower incidence of coronary artery disease (Fraser, 1988). Subsequent studies of this group revealed that this group also has lower risks of CHD (Fraser et al, 1992) and colon cancer (Fraser, 1999) and live longer (Fraser et al, 2001). In 2005, the U.S. Department of Health and Human Services recommended in their dietary guidelines that people moderate their consumption of red and processed meat (USDHHS, 2005). Further studies continued to report a dangerous connection between red meat consumption, particularly processed meats, and cardiovascular disease and cardiovascular mortality (Sinha et al, 2009; Micha et al, 2010; Pan et al, 2012; Wang et al, 2016). Many studies have also warned about a causal association between red meat consumption and type II diabetes mellitus (Pan et al, 2011; Feskens et al, 2013; Mari-Sanchis et al, 2016) and some cancers, (Larsson et al, 2012; Wu et al, 2016; Wolk, 2017) especially colorectal cancer (Zheng et al, 2009; Chan et al, 2011; Aykan, 2015). Besides increased cardiovascular deaths, increased consumption is also associated with an increase in all-cause mortality (Larsson et al, 2014; Wang et al, 2016). No detrimental cardiovascular association has been noted with white meat (Battaglia et al, 2015). However, despite these reports, red meat intake in the US and most of the world has continued to rise (AICR, 2007; Daniel et al, 2011). This communication looks at the major evidence based data implicating red meat, especially processed meat consumption, in increasing the risk of cardiovascular disease and cardiovascular mortality.

2. METHODS

A comprehensive literature search was carried out using the PubMed and PubMed Central database of the US National Library of Medicine, National Institutes of Health, on 'red meat and cardiovascular diseases'. Other contemporary and complementary medicine databases (including Medline, Google Scholar, and Quertile) databases were also queried and relevant publications were consulted. Available scientific grey material was also reviewed. Only English language literature was reviewed.

3. RESULTS

When queried under 'red meat and cardiovascular diseases', PubMed revealed 338 citations dating back to 1983 while PMC revealed 4484 full length publications. Under 'processed meat and cardiovascular diseases', there were 156 citations in PubMed dating back to 1970 and 2856 citations under PMC.

4. DISCUSSION

Cardiovascular diseases (CVD's) continue to claim the dubious distinction of being the number one killer in the world, resulting in 17.5 million deaths in 2013 (Heart.org, 2017). Its global death impact is expected to grow to more than 23.6 million deaths by the year 2030. CVDs include coronary artery disease, heart failure, stroke, cardiac arrhythmias and peripheral vascular disease. CVD's are also a leading cause of disability throughout the world, and exert extensive emotional and financial burden on individuals, families, societies and states (Gaziano, 2007). The major risk factors for CVD's are well known (Fryar et al, 2012), and include hypertension (Kearney et al, 2005), diabetes mellitus (Ferrannini et al, 2012), hypercholesterolemia (CTT, 2008), obesity (Marie et al, 2014), smoking (Mons et al, 2015), stress and anxiety (Lichtman et al, 2008), inactivity (Hakim et al, 1999), and an imprudent diet (Lichtenstein et al, 2006). High consumption of red meat and processed red meat is absent or low in a prudent heart healthy diet.

4.1. What is red meat, processed meat and white meat?

Red meat is usually referred to the muscle meat from beef, veal, pork, lamb, horse, deer and some types of game. Certain parts of chicken and the muscle tissue of ducks and geese are also red meat. It is usually made of slow twitch fibers. Red meat muscle tissue

also has myoglobin count higher than 65%. White meat usually refers to poultry, fish, amphibians, and reptiles, is lighter in color and is mainly made of fast twitch fibers. "Processed meat" refers to meat, with added water, salts and other compounds, mainly to extend their shelf life. These include bacon, hot dogs, sausages, cold cuts and other predominantly red meats.

4.2. Red meat and Coronary Artery Disease

Several studies have warned against the higher risk of developing coronary artery disease with increasing red meat consumption (Whiteman et al, 1999; Liu et al, 2003; Sinha et al, 2009). Similar data indicating a high risk for ischemic heart disease with the intake of processed meats has also been published (Salonen et al, 1992; Kelemen et al, 2005; Sinha et al, 2009). In a meta-analysis of two cohort studies, Pan and his group followed 37698 men from the Health Professionals Follow-up Study (1986-2008) and 83644 women from the Nurses' Health Study (1980-2008), documenting 23,926 deaths from various causes during 2.96 million person-years of follow-up. There were 5,910 cardiovascular deaths. After multivariate adjustment for major lifestyle and dietary risk factors, the pooled hazard ratio (HR) and 95% confidence interval of total mortality was 1.13 (1.07-1.20) for 1-serving per day increase of unprocessed red meat, 1.18 and 1.21 for processed red meat. The CVD mortality was presumably primarily from ischemic heart disease.

4.3. Red meat and Stroke

Kaluza and associates noted an increase in the consumption of red meat and ischemic strokes (Kaluza et al, 2012). In a meta-analysis of five prospective cohort studies, involving a total of 2 39 251 subjects and 9593 stroke events, Chen and associates found that the relative risk for ischemic stroke were 1.15 for total meat (red and processed meat combined), 1.13 for red meat and 1.19 for processed meat. No detrimental association was seen with hemorrhagic stroke. They concluded that for each 100g per day increment in total meat, risk of stroke increased by 10%, for red meat, 13% and for each 50g per day increment in processed meat consumption, 11% (Chen et al, 2013). Similar increases were noted in a meta-analysis of seven prospective cohort studies by Yang and associates. In this study involving 2,079,236 subjects and 21,730 strokes, total red meat consumption was associated with an increase in ischemic stroke with a relative risk of 1.22 (Yang et al, 2016).

4.4. Red meat and heart failure

Several studies have implicated red meat intake with an increased likelihood of developing heart failure (Nettleton et al, 2008; Ashaye et al, 2011). In a prospective follow-up trial on 37 035 Swedish men, Kaluza and associates found that total and processed red meat consumption were associated with greater heart failure incidence and related mortality during an \approx 12-year follow-up (Kaluza et al, 2014). In this study, there was a 28% increase in heart failure in men consuming 1.2 servings/day of processed red meat and a 43% more increase in heart failure related deaths in those consuming 0.2 servings/day. Kaluza and associates reported that in 2,806 women with heart failure, followed for a mean of 13.2 years, women who consumed \geq 50 g/day processed red meat compared to those who consumed < 25 g/day had a statistically significant 1.23 higher risk of heart failure (Kaluza et al, 2015).

4.5. Red meat and hypertension

The association of red meat intake and high blood pressure has been reported in several publications (Steffen et al, 2005). Tzoulaki and associates concluded that red meat intake of 102.6 g/24 h or higher intake was associated with 1.25 mm Hg higher systolic blood pressure. They attributed this to the higher iron content of the red meat (Tzoulaki et al, 2008). A study to implicate animal protein in the pathogenesis of red meat related hypertension did not show any difference when compared to plant based protein (Altorf-van et al, 2012). Lajous and associates reported in 2014 that women who consumed \geq 5 servings. (50 g = 1 serving) of processed red meat/week, demonstrated a 17% higher rate of hypertension when compared to women who consumed <1 serving/week (Lajous et al, 2014). Processed meat has a much higher load of sodium, besides other compounds, that may be contributing to this phenomenon.

4.6. Cardiovascular mortality

Sinha and associates studied over half a million people and found that during a ten-year period of follow up, there were 47,976 male deaths and 23,276 female deaths. They found that cardiovascular disease risk was elevated for men and women in the highest quintile of red (HR, 1.27 and HR, 1.50 respectively) and processed meat (HR, 1.09 and HR, 1.38 respectively) intakes (Sinha et al, 2009). In a meta-analysis of cohort studies (1 674,272 individuals); in 2014, Abete and group noted a 16 % higher risk of CVD mortality with red meat consumption. They also found a 18% higher risk of CVD mortality in those with the highest category of processed meat consumption (Abete et al, 2014). In a recent meta-analysis of 8 studies involving 150,328 deaths, Wang and

associates noted that for processed meat, the pooled relative risk with an increase of one serving per day was 1.15 for cardiovascular mortality (Wang et al, 2016).

4.7. Other pathological associations

Red and processed meat is positively associated with an increased risk of obesity (Rouhani et al, 2014), colorectal cancer (Norat et al, 2005; Pham et al, 2014), and type II diabetes mellitus (Pan et al, 2011; Micha et al, 2012, Epic-Interact; 2012). Red meat consumption also increases all-cause mortality (Larson, 2014; Wang et al, 2016). The relative risks of all-cause mortality for the highest versus the lowest category of red meat consumption were 1.10 for unprocessed red meat and 1.23 for processed meat, and 1.29 for total red meat (Larsson, 2014). Recently Wang and associates reported an increase in all-cause mortality of 1.15 with an increase of only one serving per day of processed meat (Wang et al, 2016). The intake of poultry was not related to increased all-cause mortality (Rohrmann et al, 2016). Rohrmann and associates in another study concluded that a reduction of processed meat consumption to less than 20 g/day would prevent more than 3% of all deaths (Rohrmann et al, 2013).

4.8. Pathogenesis

There are many pathways by which meat consumption can increase the risk of developing cardiovascular diseases. These include higher concentrations of total serum cholesterol, low-density-lipoprotein cholesterol, and triglycerides in meat eaters when compared with individuals who consumed no meat (Slattery et al, 1991). Processed meats are higher in dietary sodium and nitrates. Dietary sodium increases blood pressure (He et al, 2002) which is a known risk factor for coronary artery disease, heart failure and stroke. Sodium also worsens arterial compliance and tends to increase vascular stiffness (Sanders, 2009). Nitrates may promote vascular dysfunction (Forstermann et al, 2008), and reduce insulin secretion, thereby impairing glucose tolerance (McGrowder et al, 2001). Glucose intolerance is a well-known factor in the pathology of cardiovascular diseases (Barr et al, 2007). Processed meat also contains added water, sodium salts, and phosphate compounds, which may worsen heart failure (Kaluza et al, 2014). Heart failure patients eating red meat may be eating less fruits and vegetables, and may lack protective micronutrients the latter provide (McKeag et al, 2012). Other processes may also play a role in the pathogenesis of cardiovascular diseases in these patients.

5. CONCLUSION

Published studies provide convincing evidence that increased consumption of red meat, particularly processed red meat, is associated with an increased risk of a wide range of serious medical illnesses, including type II diabetes and some cancers. Its causal association with cardiovascular diseases, cardiovascular mortality and all-cause mortality is also irrefutable. Adult patients, except those over the age of 70, should limit their intake of red meat, particularly processed red meat, as much as possible. It behooves health care providers, associations and governmental agencies to publicize this fact more aggressively, as the health care costs and lives saved, could be phenomenal.

ACKNOWLEDGEMENTS

None

CONFLICT OF INTEREST

None

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